

NORTHERN CALIFORNIA BOTANISTS

BOTANICAL LEAFLETS

ISSUE 14

FALL 2014



PRESIDENT'S MESSAGE

It is fall and hopefully everyone has finished their summer field work. This has been quite a year with the drought and fires. The summer flower season did not seem to linger but was over quickly. We all know people affected by fires in every part of California. It would be wonderful if we got some rain soon.

Many of us are planning to attend the California Native Plant Society Conference in

San Jose in January 2015. Northern California Botanists plan to have a booth at the conference so if you plan to go please stop by our booth.

We have added three new board members, Brett Hall, Jane Van Susteren, and Jenn Yost. Welcome to the Northern California Botanist board! And I would like to thank Joe Silveira, Chris Ivy and Mike Williams for all their work on the board

these past years.

We are beginning to plan our 2016 Symposium which will be in January, 2016 at California State University, Chico. So, there is something to look forward to.

Have a great fall with your many vast botanical adventures.

Linnea Hanson
President

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MANY THANKS TO OUTGOING BOARD MEMBERS AND WELCOME NEW BOARD MEMBERS!

After many years of serving on the Board, Joe Silveira, Chris Ivey, and Mike Williams are stepping down. Joe Silveira (U.S. Fish & Wildlife Service) was one of the founding member of NCB and has served on the Board since 2006. Chris Ivey (CSU Chico) and Mike Williams (Butte College) have served since 2008. Thank you Joe, Chris, and Mike!

Northern California Botanists is pleased to announce the election of three new Board members: Brett Hall (Director of Collections and Conservation, UC Santa Cruz Arboretum), Jane Van Susteren (Graduate Student, San Francisco State University), and Jenn Yost (Assistant Professor of Botany & Director of the Hoover Herbarium, Cal Poly, San Luis Obispo). Welcome new Board Members!

MYSTERY PLANT

This plant is naturalized in northern California and elsewhere from its native range in the eastern U.S. This perennial dies down to the ground each winter but can grow to 3 meters tall (especially in riparian areas) in the summer. The showy fruits tempt one to grow a plant in your garden, but beware! Birds will see to it that next year there is more than the one plant in your (and your neighbors') gardens.

Photo by Rob Schlising



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NORTHERN CALIFORNIA BOTANISTS IN ACTION

This issue of Leaflets features a continuing series that highlights well-known to possibly less-well-known botanists, with photographs from the present to several decades back. If you have unpublished pictures of Northern California Botanists to share, please send jpegs and relevant information to rschlinging@csuchico.edu



Mike Williams (left) and **Tom Parker** are shown in a *Weyethia* meadow of the Plumas National Forest in 1988. Both are now major mentors of students, Mike at Butte College and Tom at San Francisco State University. Dr. Parker, who publishes a great deal of his research, has just completed a term as president of the California Botanical Society. Dr. Williams was manager of the Sedgewick Reserve (UC Santa Barbara) and the Sagehen Creek Field Station (UC Berkeley) before coming north to Butte County. He served on the Northern California Botanists Board of Directors for 6 years.



Rob Preston (Senior Botanist at ICF International) publishes on numerous different groups of California plants, including geophytes and vernal pool plants. Dr. Preston has written many taxonomic treatments for both the Jepson Manual and Flora North America. He is shown on a limestone ridge where he discovered a new species, *Eriogonum callistum*, the Tehachapi buckwheat.



Emily Miegs Doe and **Tim Hanson** examining a rare moss, *Bruchia bolanderi*. Emily has worked as a botanist for both the Plumas and Mendocino National Forests, has taught horticulture at Butte College, and was a student assistant at the Chico State Herbarium. Tim worked as a botanist for Plumas National Forest several summers and completed his master's thesis at Chico State on the rare *Monardella venosa*. He is presently employed at the Geographical Information Center at Chico State.



Lauren Johnson (right), Forest Botanist on the Mendocino National Forest for 8 years, is shown in the field mentoring a Youth Conservation Corps student. With degrees from UC Berkeley and UWis, she manages her forest focusing on plant community ecology. Earlier, she was with the Modoc National Forest, and also the Kaibab National Forest (in Arizona).

2015-2016 STUDENT RESEARCH SCHOLARSHIP APPLICATIONS

Northern California Botanists provide competitive botany and plant ecology research scholarships to undergraduate and graduate students conducting research within the NCB geographic range (see our website for more information). Applications for the 2015-2016 school year will be posted on our website in November and are due in March. A flyer will also be available for posting. Please help get the word out by letting botany and plant ecology students and faculty know of this opportunity.

The NCB Scholarship Committee is working to improve our scholarship evaluation process, so there will be changes in the scholarship application materials. Make sure you use the most current application form for 2015-2016!

2014-2015 STUDENT RESEARCH SCHOLARSHIP AWARDS

Northern California Botanists is pleased to announce the recipients of this years research scholarship awards. As in the past, we received many worthy applications. This year we will be awarding 9 scholarships of \$1,000 each. The Shasta Chapter of the California Native Plant Society (Shasta, Lassen, Modoc, and Siskiyou Counties) is sponsoring one of the \$1,000 Northern California Botanists Scholarships this year.

Megan Oldfather is a PhD student at the University of California Berkeley.

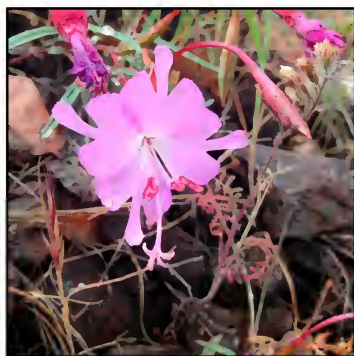
The title of her research is **“Using experimental demography to project alpine plant ranges in a warmer, drier future”**.



Despite a rich history of studying species' ranges in ecology, the relative importance of many ecological processes in shaping plants' ranges is still poorly understood. Investigation of the demographic differences between populations across a species range will inform our mechanistic understanding of current ranges, as well as potential range shifts with a changing climate. In 2013 and 2014, I surveyed 17 populations of a long-lived alpine perennial (*Ivesia lycopodioides* var. *scandularis*, Rosaceae) across the entirety of its arid altitudinal range in the White Mountains, CA. In the last two decades there has been a significant increase in temperature and decrease in precipitation in the White Mountains, and it is suggested that this species is vulnerable to extensive range contraction. Examining 3,382 individuals across 3 regions: lower elevation limit, upper elevation limit, and center of range, I ask how size-structure and demographic rates vary depending on microclimatic growing-season soil moisture and temperature. Using linear mixed-effects models, the best model fits of the data suggest a complex interaction between environmental conditions and population dynamics across the range of *Ivesia lycopodioides* var. *scandularis*. The size structure of the populations is different across the regions; smaller-sized individuals are found in populations at the lower limit, indicating faster population turnover at the trailing edge. Population density is driven by an interaction between region and site-specific soil moisture with changes in soil moisture across sites having the largest positive impact on density at the lower limit region. In addition, smaller individuals have more flowering stalks in the middle of the species' range regions compared to same-size individuals in the lower and upper regions. Mortality rates between the years varied widely between sites, but were consistent across regions. These results imply increased vigor and fecundity in the more central part of the species range, as well as illustrate the importance in microclimate in driving the variability in population dynamics both across regions as well as between populations in the same region. Future work will include a range-wide Life Table Response Experiment (LTRE) in which I will quantify and compare population sensitivity to augmented precipitation and temperature across this species' range. This work will allow a novel inference of the probability of plant range shifts in a warmer, drier future in eastern California.

2014-2015 STUDENT RESEARCH SCHOLARSHIP AWARDS (CONT.)

Shelley Sianta is a PhD student at the University of California, Santa Cruz.



The title of her research is **“The ecological context of adaptation to a novel pollinator in *Clarkia*”**.

We are fortunate to enjoy a splendor of floral diversity every spring in California. A longstanding question in evolutionary ecology is how this diversity in floral forms was created. One proposed mechanism is that plants evolve different floral forms to attract local pollinators. Because the ranges of pollinators vary across the landscape, a plant species with a wide distribution may have populations that interact with different suites of pollinators, creating different selective pressures on flowers from different populations. Divergence in floral forms and pollinator use among populations may result in the creation of new species. Two California endemic sister-species in the genus *Clarkia* may be an example of pollinator-mediated divergence and speciation. The new species, *C. breweri*, is the only species in the genus that is pollinated by nocturnal hawk-moths. The flowers of *C. breweri* are very different from its progenitor species *C. concinna* – they are large, pale pink flowers that have a strong, sweet fragrance. These floral traits are characteristic of hawkmoth-pollinated flowers. However, some of the “ancestral” pollinators of *C. breweri* (i.e., diurnal insect pollinators of *C. concinna*) are present in the *C. breweri* range and visit *C. breweri* at low rates.

My research tries to understand how and why the evolution of this new floral form occurred, given that both the ancestral (diurnal insect) pollinators and the new (hawkmoth) pollinator are present in current *C. breweri* populations. My hypothesis is that *C. breweri* adapted to hawkmoth pollinators via evolution of a new floral form because hawkmoths deliver higher quality pollen (i.e., from more genetically diverse pollen donors) than the diurnal insect pollinators. With support from NCB, I’m using field-based studies complemented with genetic analyses to assess the effect different pollinators have on quality of pollen delivered, female fitness, and offspring quality of *C. breweri*.

Sandra Namoff is a PhD student at Claremont Graduate University



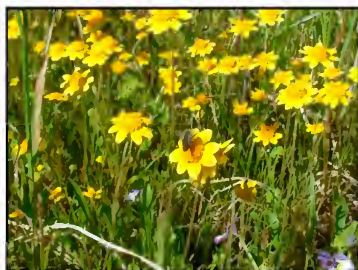
The title of her research is **“Conservation genetics of *Calystegia stebbinsii*, a rare edaphic endemic of the Northern Sierra Nevada foothills”**.

Genetic monitoring can be used to investigate how populations of rare species are responding to habitat threats and environmental variation. Genetic diversity within a population can be understood as a proxy of a species’ adaptive potential. In the foothills along the western slope of the Northern Sierra Nevada is an intrusion of gabbroic-volcanic rock called the Pine Hill complex that hosts a suite of six rare species. Among them is *Calystegia stebbinsii* Brummitt, a fire-adapted herbaceous perennial afforded legal protection by federal and state governments. The greatest threats to this species are human activities associated with urban development including land conversion and changes to fire frequency, as well as ecological factors including competition from invasive exotics. In this study microsatellite data is used to understand inbreeding, genetic structure and population size of *Calystegia stebbinsii*. Population genetic data will guide management of the species, and assist in the design of conservation actions to preserve the current genetic diversity for this rare species and thus maximize its evolutionary potential for the future.

2014-2015 STUDENT RESEARCH SCHOLARSHIP AWARDS (CONT.)

Lorena Torres Martinez is a PhD student at Purdue University.

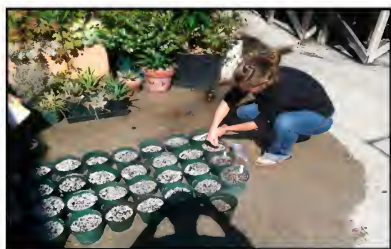
The title of her research is **“Adaptive potential of vernal pool goldfields to climate change”**.



Species with patchy habitats and/or restricted dispersal potential will be least likely to track their optimal climate conditions through dispersal under the projected scenarios of global climate change. Instead, the persistence of these species may largely depend on their potential to adapt *in situ* to novel climate regimes. *Lasthenia fremontii* (Fremont's Goldfields), an obligately outcrossing annual plant species endemic to the vernal pools in the Great Central Valley of California, serves as an outstanding ecological model species to understand how patchily-distributed species will respond to climate change. Vernal pools are geographically isolated ephemeral wetlands characteristic of regions with Mediterranean climates. In California, climate change is expected to drastically shift the patterns of rainfall, and precipitation-dependent wetlands like vernal pools may be particularly impacted. *L. fremontii* is considered to only be locally-dispersed due to the island-like structure of the vernal pools, the highly localized pollinator foraging behavior and the gravity-mediated dispersal of its seeds. Preliminary results on the estimation of genetic relationships among populations across the range of *L. fremontii* using single nucleotide polymorphisms (SNPs) suggest that gene flow may be restricted to highly local spatial scales. Collectively, these factors might be promoting genetic differentiation and facilitating local adaptation among populations that occupy different vernal pools. Therefore, I hypothesize that both latitudinal differences in the amount of precipitation across California and the local dispersal propensity of *L. fremontii* have led to adaptive divergence in climatic tolerances among populations across the species range. In the proposed project, I will estimate 1) the extent to which geographically distant populations are locally adapted to historical precipitation conditions, and 2) the amount of genetic variation within populations that will determine the potential for *L. fremontii* populations to adapt to changing precipitation conditions. I will test this hypothesis by submitting individuals from three populations across the range of *L. fremontii* to three inundation treatments that simulate the flooding regimes associated with contrasting El Niño and La Niña rainfall patterns. This work will provide critical information for the restoration, conservation and management of vernal pool plant communities in the face of climate change.

Kristen Nelson is an MS student at California Polytechnic State University, San Luis Obispo.

The title of her research is **“Floral Color Change in California Species of *Lupinus*, do taxa in the genus *Lupinus* uniformly manipulate pollinators through floral color change?”**



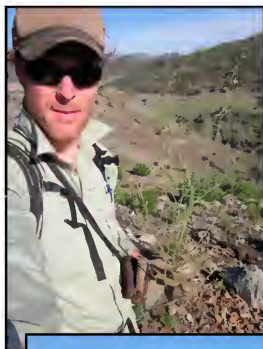
Kristen will be studying the significance of floral color change in the genus *Lupinus*, a trait that is observed extensively, if not universally, throughout the genus. The retention of reproductively spent flowers on an inflorescence is believed to function as a visual cue to pollinators that are far away. However, once a pollinator reaches the inflorescence, the color of the banner petal may direct pollinators to only those flowers that still require pollination. Of particular interest is the apparently uniform expression of this trait in both annual and perennial species. Research supports that annual lupines are primarily self-pollinated while perennial species are primarily outcrossed. If this is the case, floral color change in annuals might function to increase outcrossing initially, with the subsequent self-fertilization to ensure some reproductive output for the season. Conversely, the expression of floral color change in annual species may be a vestigial trait or it may be performing a previously unidentified function for the individual. I will examine the prevalence and significance of floral color change in lupines by focusing on four primary questions: (1) how extensive is this trait within the genus *Lupinus*; (2) do annual and perennial species respond differently to self-pollination and cross-pollination; (3) does floral color change occur following self-pollination, cross-pollination, and/or in the absence of pollination; and (4) do pollinators respond to different colors of banner petals?

2014-2015 STUDENT RESEARCH SCHOLARSHIP AWARDS (CONT.)

Kyle Christie is a PhD student at the University of California, Davis.

The title of his research is

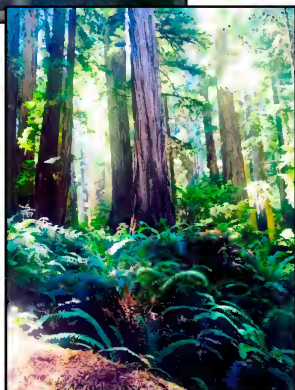
“Speciation mechanisms in *Streptanthus*: A flagship endemic of the California flora”.



The California Floristic Province (CFP) is a worldwide biodiversity hotspot and supports well over 5,500 plant species, approximately 40% of which are endemic to the state. California hosts more endemic plant taxa than any other comparably sized area in North America. This sheer amount of diversity begs the question, how did all of these species originate? Recent research suggests that the CFP's plant diversity stems from historically low extinction rates as opposed to unusually high speciation rates. Numerous lineages may have accumulated here over long time scales, however a large proportion of the state's endemic species are believed to be of relatively recent origin and to have originated locally. How does one ancestral plant lineage diverge into two? Which ecological or genetic mechanisms prevent gene flow? One of the most challenging, yet potentially illuminating goals in current speciation research is to determine which components of reproductive isolation are in place during speciation. Quantifying the strength of different isolating barriers between recently diverged taxa serves to greatly improve our mechanistic understanding of the speciation process.

The genus *Streptanthus* Nuttall is comprised of ca. 35 species, the majority of which are endemic to California. An unusually high number of *Streptanthus* taxa (ca. 40%) are restricted to serpentine substrates, and are believed to be neoendemics. My research aims to quantify barriers to gene flow between the recently diverged serpentine endemics *S. breweri* and *S. hesperidis* in portions of Lake and Napa counties where the two species co-occur. Greenhouse crosses suggest that the species are at least partially inter-fertile, yet no obvious hybrids occur in the field. I hope to understand how pre-zygotic barriers to gene flow including microhabitat partitioning, phenology, pollinator communities, and pollen-pistil incompatibility, as well as post-zygotic genetic incompatibilities and hybrid fitness, have shaped the speciation process in this unique group of serpentine endemics.

Claire Willing is a PhD student at the University of California, Berkeley.



The title of her research is **“Bottom-up impacts of mycorrhizal communities on the ecology and physiology of coast redwood trees”.**

The California coast redwood (*Sequoia sempervirens*) is an iconic species that boasts the second highest standing biomass on earth and fixes and sequesters 3-5 times more carbon per unit area than the Amazon rainforest. Coastal redwood forests face significant threats due to climate change-induced drought as California's coastal temperatures are warmer now than they have been in the past 100 years, and fog has declined by 33%. These troubling facts point to an urgent need to monitor impacts on *S. sempervirens* physiology due to climate change as fog subsidies comprise 25-37% of annual water inputs for this system. Research efforts have primarily focused on mature trees and on aboveground physiology. However, given the fundamental role of belowground structures in water acquisition, rooting systems likely have a significant impact on these trees' response to drought.

Early work showed that *S. sempervirens* form symbiotic associations with arbuscular-mycorrhizal fungi (AMF), yet we know little about the identity of these symbionts or the role they play in water acquisition. Furthermore, with coastal climates changing rapidly, enhancing our understanding of AMF in redwood functional ecology will be essential in determining the role these fungi play in physiological adaptation to drought and the ability of these forests to sequester carbon. I am working to analyze which fungi preferentially colonize seedling roots. In addition, I perform functional assays comparing whole-root hydraulic conductance, stem hydraulic conductance, and leaf surface area and nutrient content between varying inoculums. These inoculums will be collected throughout the redwood range along a naturally existing precipitation gradient. Ultimately, the goal of this research is to understand if the presence of AMF or particular AMF communities impact water-status of coast redwood.

2014-2015 STUDENT RESEARCH SCHOLARSHIP AWARDS (CONT.)

Arielle Halpern is a PhD student at the University of California, Berkeley



The title of her research is “**Cultural prescribed fire and *Notholithocarpus densiflorus* associated cultural plant resources of the Karuk and Yurok Tribes of California**”.

Fire is a major contributor to regional and local patterns of diversity in the mixed evergreen and conifer dominated forests of the Klamath Bioregion in Humboldt and Siskiyou Counties. Historically, Native Californian tribes capitalized on the biological heterogeneity fostered by fire to maintain important cultural resource systems for the procurement of foods, materials, and medicines. Tanoak acorns (*Notholithocarpus densiflorus*, Fagaceae) are an important terrestrial resource system to the Karuk and Yurok People of the Klamath River, California. The targeted, seasonal application of prescribed fire was historically utilized to reduce acorn infestation from Filbertworm (*Cydia latiferreana*, Tortricidae) and Filbert Weevil (*Curculio occidentalis*, Curculionidae) larvae and encourage Tanoak associated species of cultural value. Our project seeks to investigate 1) the effects of indigenous prescribed fire on the abundance and quality of Tanoak acorns 2) the role of cultural burning in the maintenance of diverse Tanoak understory assemblages from which the Karuk and Yurok peoples obtained a variety of plant resources and 3) the effects of harvesting and altered fire regimes on Tanoak interspecific interactions. I conduct vegetation assessments documenting site level vegetation characteristics, species present/absence, percent cover, and morphological changes of cultural significance in pre-, post-, and un-burned heritage Tanoak gathering sites. I make monthly acorn collections at these sites during the fall season to monitor overall production and infestation related to treatment and site characteristics. This project is conducted in collaboration with the Karuk and Yurok Tribes of California. The mission of these collaborative relationships is to unite traditional knowledge and scientific methods to generate research that benefits both tribal and scientific communities and to find novel adaptive solutions to promote sustainable resource management, reduce ecosystem degradation, and preserve bio-cultural diversity.

Joan Dudney is a PhD student at the University of California Berkeley.



The title of her research is “**Invasions in the Sierra Nevada: forest management impacts on understory species**”.

Forests in the Sierra Nevada are facing an unprecedented legacy of fire suppression, which is leading to more frequent catastrophic fires. In order to mitigate the adverse effects of wildfires in California, managers have adopted various treatment strategies to reduce fuel loads. However, few studies document the exotic species response to these treatments and even fewer research long-term effects. The dearth of long-term data is problematic for two reasons: first, vegetation can take many years to recover after disturbance, and second, it is difficult to conclude whether the vegetation response directly following disturbance is ephemeral or perennial. Here we sample eleven years after treatments to overcome some of these limitations. Research will be conducted at the University of California Blodgett Forest Research Station located in the north-central Sierra Nevada. Between 2001 and 2002, the following fuel reduction treatments were replicated three times: (1) prescribed fire, (2) thinning and mastication, and (3) thinning, mastication, and prescribed fire. Preliminary data from 2003 indicated that exotic species increased following all treatments. We expect our results will show the opposite effect, that exotic and native species diversity decreases across time in all treatment plots. The longevity of this research will provide a more comprehensive understanding of invasion trends and help inform conservation and land management strategies in actively managed forests.



NORTHERN CALIFORNIA
BOTANISTS

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In addition, I would like to donate \$_____ to Northern California Botanists to help fund NCB programs and student research scholarships.

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